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ABSTRACT

This digest tries to sort out issues related to the question of whether students should be tracked in math or science. Tracking is differentiated from ability grouping, and a brief historical overview and literature review is provided. It is suggested that the answer to this question is neither yes nor no. (Contains 15 references.) (ASK)

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There seems no simple answer to this straightforward question; the answer depends on who you ask and what learning outcomes are considered most important. Studies focusing on student achievement seem to bear different results than studies focusing on equity issues, and in both cases there are questions about the educational significance of the findings. Though many researchers and educators consider the practice outdated, or even harmful to some students, many parents and teachers strongly endorse tracking. Here we will try to sort out the issues, and then suggest that the answer to whether children should be tracked in math or science is neither "yes" nor "no."

First, we differentiate tracking from ability grouping. Within a particular class, teachers often form reading groups or math groups on the basis of ability; this is an instructional management practice that enables teachers to more effectively attend to the individual needs of students. Students can move from group to group as they progress, and the whole class receives the same basic instruction. By tracking, we are referring to the practice of separating students into different courses or course sequences ("tracks") based on their level of achievement or proficiency as measured by some set of tests or course grades. This practice has been common in the United States throughout the 20th century, and even in schools where there is no formal system of tracking, the higher achieving, college-bound students take different classes—honors classes or Advanced Placement classes—than other students. By 8th grade, over two-thirds of U.S. students are grouped into differentiated math courses (Mullis, 1991).

Many educators began questioning the practice of tracking in the 1970s when studies began to show that minority and low-income students were over-represented in the lower tracks where they receive less challenging instruction from less qualified teachers (Oakes, 1990). On the basis of results from many separate studies, some have argued that students of all ability levels do no better in tracked classes than in classes of mixed ability (Slavin, 1990). These findings prompted many schools to abolish tracking.

More recent findings, however, have caused some educators to take a more cautionary approach. In one nationwide study it was found that scores for students formerly in the lower tracks did improve when the students were moved to mixed-ability groupings, but the scores of average and higher-achieving students decreased somewhat (Argys, Brewer, & Rees, 1996). The reverse effect had been documented earlier (Gamoran, 1987); tracking boosted achievement among students in the academic track, but the gains were offset by the losses experienced by students placed in the lower track. Gamoran also found that the difference in achievement between students in the upper and lower tracks was even greater than the difference between those who stayed in school and those who dropped out. One outcome of tracking, it seems, is a widening of the gap between high achievers and low achievers.

In attempting to account for the increased gap, Gamoran (1995) found that questioning patterns differ significantly in honors, regular, and remedial classes, indicating differences in the way students and teachers interact in those classrooms. Indeed, teachers in the academic tracks tend to place more emphasis on reasoning and inquiry skills than do teachers of classes in the other tracks. Students in the lower tracks also spend more time reading textbooks and completing worksheets while students in the upper tracks are more likely to participate in hands-on inquiry and write about their reasoning in solving mathematics problems. These differences in the learning environments of remedial, regular, and honors courses may account in part for the findings of Madigan (1997). In exploring patterns of science course taking, science proficiency levels, and demographic variables, he found that "the most consistent pattern seems to be that what science courses students take in high school is more related to increases in science proficiency level than the number of science courses" (p. 12). Also, math and science courses with higher proportions of minority students are more often designated as "low-ability" courses than are courses with lower proportions of minority students (National Science Foundation, 1996). Among 10th graders in 1990, Black, Hispanic, and Native American students were less likely than other 10th graders to be in an academic track (Peng & Hill, 1995) where science and math are emphasized (See Figure 1). When this placement pattern is compared to the expectations of 8th graders (See Figure 2) and the distribution of 8th graders in academic math courses (See Figure 3), one has to wonder how early children are deciding whether they are capable of advanced studies and how much influence the practice of tracking, particularly in math, is having on the perceptions.

Figure 1. Tenth Graders in Academic Track

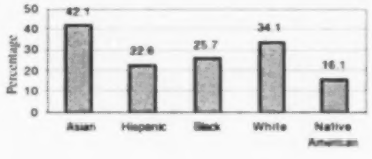


Figure 2. Eigth Graders Expecting to be in an Academic Program

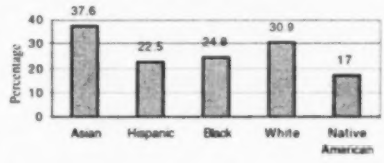
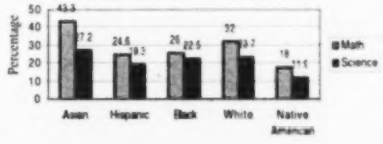


Figure 3. Eighth Graders Tracked in Math and Science



Note. All figures were constructed from data presented in National Science Foundation. (1996). *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1996* (NSF 96-311). Arlington, VA: Author. (Available online at *http://www.nsf.gov/sbe/srs/nsf96311/start.htm*)

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It is this apparent connection between demographic grouping (minorities, low-income students) and so-called ability grouping that is most troublesome. There have long been concerns about the underrepresentation of some minority groups in math and science, so are we exacerbating the problem by continuing an educational tradition that has, at best, a marginal benefit for a small group of students? Indeed, Oakes (1990) has said, "while not all students have the interests or aptitude to become scientists or mathematicians, the disparities for African-American and Hispanic minorities and the poor are so great that considerable science and mathematics talent is undoubtedly being lost from these groups" (p. 2). So, it seems the supposed "ability-grouping" tradition in math is, in effect, also a sorting process with unsettling social consequences.

In attempting to place these findings in a broader context, it is worth considering the general levels of proficiency in mathematics among high school seniors as measured by the National Assessment of Educational Progress (Mullis, 1991). Though students in academic programs, with plans to attend college, performed significantly higher in mathematical achievement than students in general and vocational programs, their average was barely above the level required to successfully understand material introduced by the 7th grade. Likewise, results from the Third International Science and Mathematics Study (see online at *http://nces.ed.gov/timss*) showed U.S. 12th graders scoring below the international average, and among the lowest of the 21 participating nations. The mathematics assessment represented a seventh-grade level curriculum for most participating nations. So, even among the best students in higher-performing schools, relatively few seem prepared for advanced mathematics, and U.S. students in general do not perform at an advanced level compared to students of other nations. These results do not present a very strong case for continuing existing practices.

One of the problems in attempting to make a decisive stand on the issue of tracking is the array of conflicting results from individual studies; despite all the debate over the issue of tracking, there has been no rigorous, large-scale study to provide a definitive accounting of the costs and benefits of tracking. Until such a study is conducted, the best we can do is decide what outcomes are most important to us, and use the most relevant findings to make local decisions. Some say (Loveless, 1999) that "detracking" is counterproductive, that it will most hurt those it is intended to help. The gap between high and low achievers will indeed narrow under mixed-ability grouping, because the high- and average-track students will likely achieve less, but the lower track students will not likely achieve more. Also, parents of high-ability students will likely transfer them out of schools that abolish tracking, or they will find other means to nurture higher achievement. It also seems that tracking does not necessarily have the same effects in all math courses (Epstein & MacIver, 1992); while lower achieving students were found to benefit from mixed-ability grouping in some math survey courses, tracking seemed to benefit all students some tracked algebra classes.

So, here is our thinking. U.S. students in general do not leave our schools particularly well prepared in mathematics; the traditional practices that so many cherish do not seem to be serving us well. Given the evidence that any marginal benefits gained from tracking by higher-achieving students come at the cost of increased barriers to lower-achieving students, the continuation of tracking seems unwarranted. If you factor in the potential benefit of using Internet resources (see Q&A article) to help students manage some of their own learning, higher achieving students would likely be just as well served by having differentiated assignments within mixed-ability classes. So, should students be tracked in math and science? For most students, the answer is clearly no; for the others, tracking has a marginal effect, but there are alternative instructional strategies that may hold even more promise.

References

Argys, L. M., Rees, D. I., & Brewer, D. J. (1996). Detracking America's schools: Equity at zero cost?. *Journal of Policy Analysis and Management, 15*(4), 623-645.

Epstein, J. L., & MacIver, D. J. (1992). *Opportunities to learn: Effects on eighth graders of curriculum offerings and instructional approaches.* (Report No. 34). Baltimore: Center for Research on Elementary and Middle Schools, Johns Hopkins University.

Gamoran, A. (1987). The stratification of high school learning opportunities. *Sociology of Education, 60*(3), 135-155.

Gamoran, A. et. al (1995, Winter). An organizational analysis of the effects of ability grouping. *American Educational Research Journal*

Loveless, T. (1999). Will tracking reform promote social equity? *Educational Leadership*, 56(7), 28-32.

Madigan, T. (1997). *Science proficiency and course taking in high school.* Washington, DC: U.S. Department of Education, National Center for Educational Statistics.

Mullis, I. V. S., et al. (1991). *The State of Mathematics Achievement: NAEP's 1990 Assessment of the Nation and the Trial Assessment of the States.* Washington, DC: United States Department of Education, Office of Educational Research and Improvement.

National Science Foundation. (1996). *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1996* (NSF 96-311). Arlington, VA: Author. (Available online at *http://www.nsf.gov/sbe/srs/nsf96311/start.htm*)

Oakes, J. (1990). *Multiplying Inequalities: The Effects of Race, Social Class, and Tracking on Opportunities to Learn Mathematics and Science.* Santa Monica, CA: Rand Corp. ED 329 615

Slavin, R. (1990). Achievement effects of ability grouping in secondary schools: A best evidence synthesis. *Review of Educational Research, 60*, 471-499.

Other Resources

Burnett, G. (1995). *Alternatives to ability grouping: Still unanswered questions* (ERIC Digest). New York: ERIC Clearinghouse on Urban Education. (Available online at http://eric-web.tc.columbia.edu/digests/dig111.html.

Davenport, L.R. (1993). *The Effects of Homogeneous Groupings in Mathematics* (ERIC Digest EDO-SE-93-6). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education. (Available online at *http://www.ericse.org/digests/dse93-6.html*)

Grouping Practices (Available online at *http://www.ncrel.org/sdrs/areas/issues/content/cntareas/math/ma1group.htm*)

Loveless, T. (1998). The tracking and ability grouping debate, available online at *http://www.edexcellence.net/library/track.html.*

Special issue on detracking. (1997). Harvard Education Letter, 13(1), January/February. (Available online at at *http://hugse1.harvard.edu/~hepg/heljf.html*)

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